

GLOBAL PRECIPITATION MEASUREMENT PRECIPITATION PROCESSING SYSTEM

**File Specification
1CMHS**

Preliminary Version

February 14, 2014

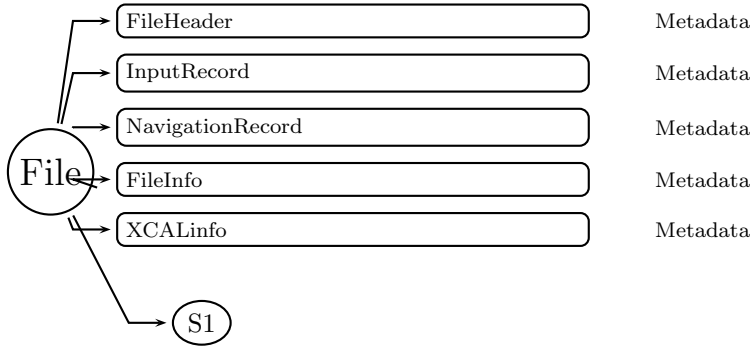


Figure 1: Data Format Structure for 1CMHS, Common Calibrated Brightness Temperature

0.1 1CMHS - Common Calibrated Brightness Temperature

1CMHS contains common calibrated brightness temperature from the MHS passive microwave instrument flown on the NOAA and METOPS satellites. Swath S1 is the only swath and has 5 channels (89.0GHzV, 157.0GHzV, 183.3GHz+/-250MHzH, 183.3GHz+/-500MHzH, and 190.3 GHzV). MHS is very similar to AMSU-B. The scan period is 2.667s.

RELATION BETWEEN THE SWATHS: S1 is the only swath, containing observations sampled 90 times along the scan.

KNOWN PROBLEMS OR ISSUES WITH REVISION 1 DATA: None.

Dimension definitions:

nscan1	var	Number of Swath 1 scans in the granule.
nchannel1	5	Number of Swath 1 channels.
npixel1	90	Number of Swath 1 pixels in one scan.
nchUIA1	1	Number of Swath S1 unique incidence angles.

Figure 1 through Figure 4 show the structure of this product. The text below describes the contents of objects in the structure, the C Structure Header File and the Fortran Structure Header File.

FileHeader (Metadata):

FileHeader contains general metadata. This group appears in all data products. See Metadata for GPM Products for details.

InputRecord (Metadata):

InputRecord contains a record of input files for this granule. This group appears in Level 1 and Level 2 data products. Level 3 time averaged products have the same information separated into 3 groups since they have many inputs. See Metadata for GPM Products for details.

NavigationRecord (Metadata):

NavigationRecord contains navigation metadata for this granule. This group appears in Level 1 and Level 2 data products. See Metadata for GPM Products for details.

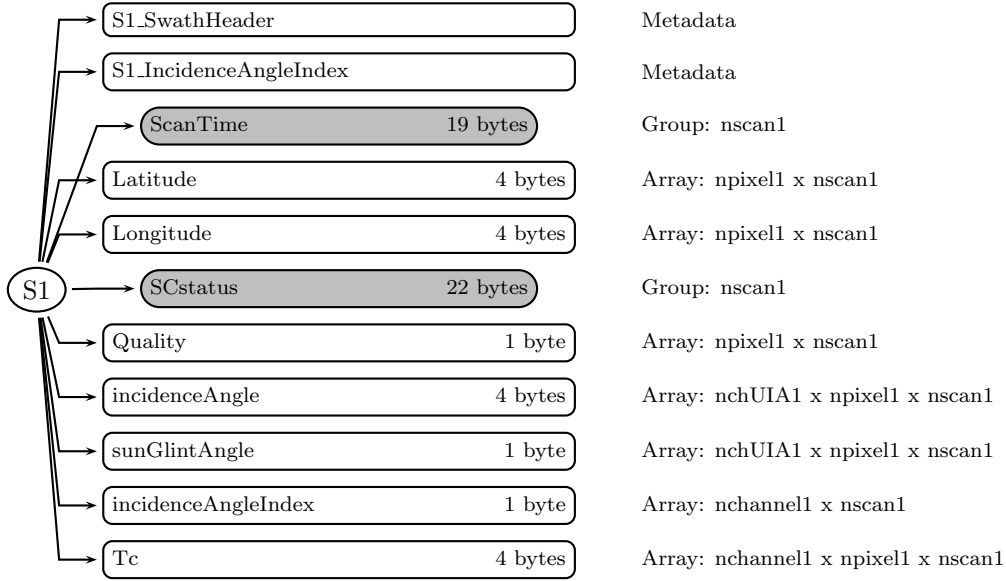


Figure 2: Data Format Structure for 1CMHS, S1

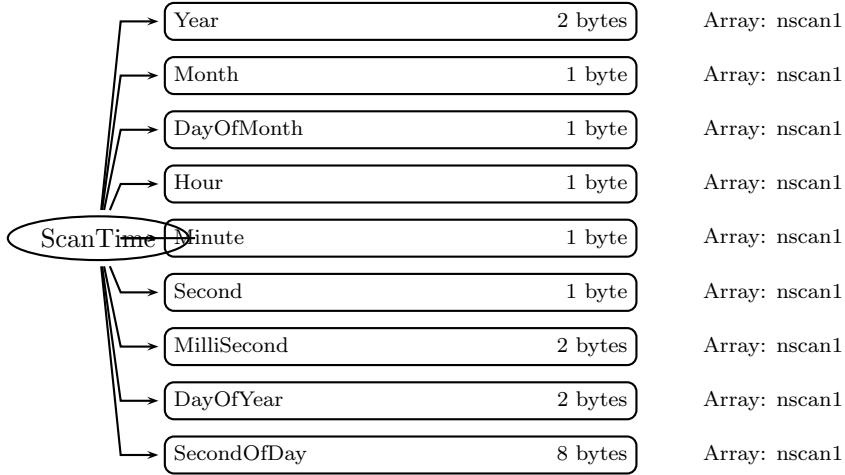


Figure 3: Data Format Structure for 1CMHS, ScanTime

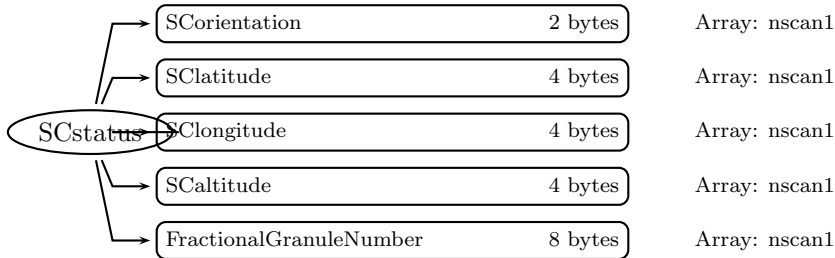


Figure 4: Data Format Structure for 1CMHS, SCstatus

FileInfo (Metadata):

FileInfo contains metadata used by the PPS I/O Toolkit (TKIO). This group appears in all data products. See Metadata for GPM Products for details.

XCALinfo (Metadata):

XCALinfo contains metadata required by 1C intercalibrated files. See Metadata for GPM Products for details.

S1 (Swath)**S1_SwathHeader** (Metadata):

SwathHeader contains metadata for swaths. This group appears in Level 1 and Level 2 data products. See Metadata for GPM Products for details.

S1_IncidenceAngleIndex (Metadata):

IncidenceAngleIndex contains a list of indices of the incidence angle array and sun glint angle array. See the description of the data array incidenceAngleIndex for details.

ScanTime (Group)**Year** (2-byte integer, array size: nscan1):

4-digit year, e.g., 1998. Values range from 1950 to 2100 years. Special values are defined as:

-9999 Missing value

Month (1-byte integer, array size: nscan1):

Month of the year. Values range from 1 to 12 months. Special values are defined as:

-99 Missing value

DayOfMonth (1-byte integer, array size: nscan1):

Day of the month. Values range from 1 to 31 days. Special values are defined as:

-99 Missing value

Hour (1-byte integer, array size: nscan1):

UTC hour of the day. Values range from 0 to 23 hours. Special values are defined as:

-99 Missing value

Minute (1-byte integer, array size: nscan1):

Minute of the hour. Values range from 0 to 59 minutes. Special values are defined as:

-99 Missing value

Second (1-byte integer, array size: nscan1):

Second of the minute. Values range from 0 to 60 s. Special values are defined as:

-99 Missing value

MilliSecond (2-byte integer, array size: nscan1):

Thousandths of the second. Values range from 0 to 999 ms. Special values are defined as:

-9999 Missing value

DayOfYear (2-byte integer, array size: nscan1):

Day of the year. Values range from 1 to 366 days. Special values are defined as:

-9999 Missing value

SecondOfDay (8-byte float, array size: nscan1):

A time associated with the scan. scanTime_sec is expressed as the UTC seconds of the day. Values range from 0 to 86400 s. Special values are defined as:

-9999.9 Missing value

Latitude (4-byte float, array size: npixel1 x nscan1):

The earth latitude of the center of the IFOV at the altitude of the earth ellipsoid. Latitude is positive north, negative south. Values range from -90 to 90 degrees. Special values are defined as:

-9999.9 Missing value

Longitude (4-byte float, array size: npixel1 x nscan1):

The earth longitude of the center of the IFOV at the altitude of the earth ellipsoid. Longitude is positive east, negative west. A point on the 180th meridian has the value -180 degrees. Values range from -180 to 180 degrees. Special values are defined as:

-9999.9 Missing value

SCstatus (Group)

SCorientation (2-byte integer, array size: nscan1):

The angle of the spacecraft vector (v) from the satellite forward direction of motion, measured clockwise facing down. The relationship of v to the sensor geometry is defined in the introduction to this algorithm. Values range from 0 to 360 degrees. Special values are defined as:

-9999 Missing value

SClatitude (4-byte float, array size: nscan1):

Values range from -90 to 90 degrees. Special values are defined as:

-9999.9 Missing value

SClongitude (4-byte float, array size: nscan1):

Values range from -180 to 180 degrees. Special values are defined as:

-9999.9 Missing value

SCaltitude (4-byte float, array size: nscan1):

Values range from 0 to 1000 km. Special values are defined as:

-9999.9 Missing value

FractionalGranuleNumber (8-byte float, array size: nscan1):

The floating point granule number. The granule begins at the Southern-most point of the spacecraft's trajectory. For example, FractionalGranuleNumber = 10.5 means the spacecraft is halfway through granule 10 and starting the descending half of the granule. Values range from 0 to 100000. Special values are defined as:

-9999.9 Missing value

Quality (1-byte integer, array size: npixel1 x nscan1):
Quality of Tc in the swath.

GENERAL SPECIFICATIONS:

0 = Good data in all channels in the swath
gt 0 = Cautionary warning flags
 1-99 = Generic flags (all sensors)
 100-127 = Sensor specific flags
lt 0 = Major errors resulting in missing data
 -(1-98) = Generic flags (all sensors)
 -99 = Missing value (no quality information available)
 -(100-127) = Sensor specific flags

DETAILED SPECIFICATIONS:

0 = Good data
1 = Possible sun glint
2 = Possible radio frequency interference
3 = Degraded geolocation data
4 = Data corrected for warm load intrusion

-1 = Data is missing from file or unreadable
-2 = Unphysical brightness temperature (Tb lt 50K or 350K gt Tb)
-3 = Error in geolocation data
-4 = Data missing in one channel
-5 = Data missing in multiple channels
-6 = Lat/lon values are out of range
-99 = Missing value (no quality information available)

incidenceAngle (4-byte float, array size: nchUIA1 x npixel1 x nscan1):

Earth incidence angle. Values range from 0 to 90 degrees. Special values are defined as:
-9999.9 Missing value

sunGlintAngle (1-byte integer, array size: nchUIA1 x npixel1 x nscan1):

Sun glint angle. Angles greater than 127 degrees are set to 127. Values range from 0 to 127 degrees. Sun below horizon value is -88. Missing value is -99.

incidenceAngleIndex (1-byte integer, array size: nchannel1 x nscan1):

Index (1 based as in Fortran) of
the incidence angle array corresponding to the channel.
For example, if the swath has 10 channels and
2 unique incidence angles, then the dimensions

in Fortran would be:

```
incidenceAngle(2,npixel,nscan)
sunGlintAngle(2,npixel,nscan)
incidenceAngleIndex(10,nscan)
Tc(10,npixel,nscan)
```

The user would do the following to retrieve the angles for a given channel, pixel, and scan:

```
i = incidenceAngleIndex(channel,scan)
ia = incidenceAngle(i,pixel,scan)
sga = sunGlintAngle(i,pixel,scan)
```

The incidenceAngleIndex is the same for every scan, but is repeated each scan for the convenience of users reading the data scan by scan. In addition, incidenceAngleIndex is located in metadata for the convenience of users wishing to read this information from metadata.

Values range from 0 to 100. Special values are defined as:

-99 Missing value

Tc (4-byte float, array size: nchannel1 x npixel1 x nscan1):

GPM Common Calibrated Brightness Temperature. The channels are:

89.0	GHz vertically-polarized	TBs
157.0	GHz vertically-polarized	TBs
183.3	GHz +/-250MHzH horizontally-polarized	TBs
183.3	GHz +/-500MHzH horizontally-polarized	TBs
190.3	GHz vertically-polarized	TBs

C Structure Header file:

```
#ifndef _TK_1CMHS_H_
#define _TK_1CMHS_H_
```

```
#ifndef _SCSTATUS_
#define _SCSTATUS_
```

```
typedef struct {
```

```

        short SCorientation;
        float SClatitude;
        float SClongitude;
        float SCaltitude;
        double FractionalGranuleNumber;
    } SCSTATUS;

#endif

#ifndef _SCANTIME_
#define _SCANTIME_

typedef struct {
    short Year;
    signed char Month;
    signed char DayOfMonth;
    signed char Hour;
    signed char Minute;
    signed char Second;
    short MilliSecond;
    short DayOfYear;
    double SecondOfDay;
} SCANTIME;

#endif

#ifndef _L1CMHS_S1_
#define _L1CMHS_S1_

typedef struct {
    SCANTIME ScanTime;
    float Latitude[90];
    float Longitude[90];
    SCSTATUS SCstatus;
    signed char Quality[90];
    float incidenceAngle[90][1];
    signed char sunGlintAngle[90][1];
    signed char incidenceAngleIndex[5];
    float Tc[90][5];
} L1CMHS_S1;

#endif

```



```
#ifndef _L1CMHS_SWATHS_  
#define _L1CMHS_SWATHS_
```

```
typedef struct {  
    L1CMHS_S1 S1;  
} L1CMHS_SWATHS;
```

```
#endif
```

```
#endif
```

Fortran Structure Header file:

```
STRUCTURE /SCSTATUS/  
    INTEGER*2 SCorientation  
    REAL*4 SClatitude  
    REAL*4 SClongitude  
    REAL*4 SCaltitude  
    REAL*8 FractionalGranuleNumber  
END STRUCTURE
```

```
STRUCTURE /SCANTIME/  
    INTEGER*2 Year  
    BYTE Month  
    BYTE DayOfMonth  
    BYTE Hour  
    BYTE Minute  
    BYTE Second  
    INTEGER*2 MilliSecond  
    INTEGER*2 DayOfYear  
    REAL*8 SecondOfDay  
END STRUCTURE
```

```
STRUCTURE /L1CMHS_S1/  
    RECORD /SCANTIME/ ScanTime  
    REAL*4 Latitude(90)  
    REAL*4 Longitude(90)  
    RECORD /SCSTATUS/ SCstatus  
    BYTE Quality(90)  
    REAL*4 incidenceAngle(1,90)  
    BYTE sunGlintAngle(1,90)  
    BYTE incidenceAngleIndex(5)  
    REAL*4 Tc(5,90)
```

END STRUCTURE

STRUCTURE /L1CMHS_SWATHS/
 RECORD /L1CMHS_S1/ S1
END STRUCTURE